Washington State Department of Transportation

Vancouver HOV Lane Pilot Project

Evaluation Report #1

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Image Analysis

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PURPOSE

This report is the first in a series of evaluation reports that monitor the effectiveness of the Southbound I-5 HOV Lane Pilot Project that opened to traffic on October 29, 2001. Data was collected by various agencies both before and after the HOV lane was implemented. Information contained in this report will compare the "after" information to the baseline information contained in the Baseline Report completed by WSDOT and the consultant team in November 2001 and issued with this report.

Figure 1 shows the HOV lane corridor as well as traffic count and monitoring locations.

Figure 1. I-5 Vancouver HOV Lane and Count/Monitoring Locations

HOV LANE GOALS

The goals of the Vancouver HOV Lane Pilot Project are:

1. **Move more people per lane** in the HOV lane during the AM peak period **than in either of the adjacent general-purpose lanes**.
2. **Reduce peak period travel** time for HOV lane users.
3. **Maintain or improve travel time reliability for carpools, vanpools and transit**.
4. **Increase the use of carpools, vanpools, and transit**.
5. **Maintain safety** by not increasing the accident and incident rate in the corridor during HOV lane operating periods.
6. **Maintain the HOV lane's effectiveness with appropriate enforcement**.
7. **Minimize impacts to other traffic** in the corridor and on parallel facilities.
8. **Assess public opinion as to the effectiveness of HOV lanes**.

EVALUATION (PERFORMANCE) MEASURES

An Interagency Team, comprised of representatives from the Washington State Department of Transportation (WSDOT), C-TRAN, the City of Vancouver, Southwest Washington Regional Transportation Council (RTC), Oregon Department of Transportation (ODOT), and Metro, established the following performance measures to be used to evaluate the HOV Lane Pilot Project:

Operations – total persons using the corridor, travel times (HOVs, Single Occupant Vehicles [SOVs], and freight), safety, enforcement, traffic impacts to parallel routes, and traffic operations at the beginning and ending transitions.

Modal Impact – HOV lane utilization, transit ridership, increase in transit service, number of persons per vehicle, Park-and-Ride use, vanpool use, employer programs.

Public Opinion – Public perceptions of success. This will include survey results, phone calls, internet comments, etc.

This report is the first post-HOV opening evaluation report and describes the baseline and post-HOV lane opening conditions for each of the HOV lane goals.

DATA COLLECTION METHODOLOGY

Before and after traffic count data were collected from WSDOT, City of Vancouver, RTC, and Clark County. Bus passenger counts were collected by C-TRAN. The consultant team performed travel time runs as well as vehicle occupancy counts using standard and nationally-accepted data collection techniques.

Vehicle occupancy counts consist of counting every vehicle in a single lane for 15-minute intervals and noting the number of occupants in each vehicle. Bus ridership was developed using C-TRAN counts provided for those routes using the I-5 corridor on the same dates that vehicle occupancy counts were taken. Percentages of the number of vehicles and persons for each travel mode were then applied to traffic counts, taken for each lane, by WSDOT's automated traffic recorders which provide continuous traffic counting. In the appendix is a description of the data collection process for travel time runs.

HOV LANE GOALS:

1. Move more people in the HOV lane during the AM 3-hour period than in either of the adjacent general-purpose lanes.

This measure is the total number of persons traveling the corridor during the a.m. peak hour or period. **Table 1** shows the total number of person trips based on counts taken in May 2001 (vehicle occupancies) and September 2001 (counts) prior to HOV Lane opening (called the "Baseline"). Because C-TRAN initiated additional Three Hour Period service on I-5 in September 2001, transit ridership counts are from September 2001, instead of May. **Table 2** shows the number of persons per lane, measured at 33rd Street, for the three through traffic lanes in that section.

Table 1. Total Person Trips Using the I-5 Corridor

Measure	Baseline (September 2001)		After HOV Opening (November 2001)	
	Vehicles	Persons	Vehicles	Persons
Three Hour Count (6-9 am)	8,990	10,084	8,847	10,848
Change from Baseline	N/A	N/A	-138	+764
Percent Change from Baseline	N/A	N/A	-2%	+8%
Peak Hour Count (7-8 am)	3,116	3,579	2,846	3,569
Change from Baseline	N/A	N/A	-270	-10
Percent Change from Baseline	N/A	N/A	-9%	0%

Measured at 33rd Street for the three through traffic lanes.

Table 2. Persons Per Lane

Measure	Baseline (September 2001)	After HOV Opening (November 2001)	
	All Lanes	HOV Lane	Each GP Lane
Three Hour Count (6-9 am)	3,361	2,336	4,256
Peak Hour Count (7-8 am)	1,193	979	1,295

Measured at 33rd Street for the three through traffic lanes.

Table 3 shows the average vehicle occupancy (all persons using the corridor divided by the total number of vehicles) and average auto occupancy (person trips in autos divided by the number of autos). Average vehicle occupancy reflects person trips occurring in all modes of travel on I-5. Average auto occupancy is important as it shows the person trips occurring in drive alone, carpool, and vanpool modes and any shift that may occur within auto modes.

Table 3. Average Vehicle Occupancy

Measure	Baseline	After HOV Opening	Change
Three Hour Average Vehicle Occupancy	1.12	1.23	+0.11
Three Hour Occupancy, Autos Only	1.06	1.15	+0.09
Peak Hour Average Vehicle Occupancy	1.15	1.25	+0.10
Peak Hour Occupancy, Autos Only	1.07	1.17	+0.10

Based on measurements taken at 33rd Street.
Auto occupancy is persons in passenger autos divided by the number of autos
Vehicle occupancy is total persons in all vehicles (including transit).

Findings To Date

- The number of peak period persons on I-5 has increased since HOV opening even though the number of vehicles has declined.
- The number of peak hour persons using the I-5 corridor has not changed even though the number of vehicles has declined.
- At this time, the HOV lane is not carrying more persons per lane than either of the adjacent general purpose lanes.
- The HOV lane has contributed to an increase in the average auto and average vehicle occupancies on I-5.
- Since the number of vehicles has decreased but the number of person trips has increased, ridesharing has increased in the corridor due to the HOV lane.

The tables above are summaries of vehicle occupancy counts, traffic counts, and bus ridership counts taken before and after the HOV lane opened. **Tables 4 through 7** give baseline and "post-opening" total number of persons carried in the corridor and mode shares as well as comparing the average auto and vehicle occupancies to the baseline data. These tables are mode detailed summaries of the vehicle occupancies, mode shares, and vehicle and person trip usage in the I-5 corridor. **Tables 4a and 6a** respectively summarize the baseline three-hour and peak hour person-trip mode shares for all three through traffic lanes while **Tables 4b** and **6b** summarize the three-hour and peak hour person-trip mode shares for the post-opening reporting period. **Tables 5a** and **7a** are for the HOV lane (three hour period and peak hour, respectively) while **Tables 5b** and **7b** are Three Hour Period and peak hour tables summarizing the two through general purpose traffic lanes.

Table 4a. Baseline Three-Hour Persons by Mode for all Lanes on Southbound I-5

Measured Near 33rd Street

Mode	6 to 9 a.m. Number of Vehicles	Total Persons	Percent of Total Persons
Drive alone	7,695	7,695	76%
Carpool: 2-person	469	938	9%
Carpool: 3+ person	47	141	1%
Trucks	755	755	8%
Motorcycles	0	0	0%
Buses	25	555	6%
TOTAL	8,990	10,084	100%

Occupancy counts (each mode's share of total traffic) taken May 16 and 17, 2001
Traffic counts taken in September 2001
Bus data obtained from C-Tran

Average vehicle occupancy = total number of persons/total number of vehicles
Average vehicle occupancy = 10,084/8,990 = 1.12
Average auto occupancy = total number of non-transit persons/total number of non-transit vehicles
Average auto occupancy = 9,529/8,965 = 1.06

Table 4b. Post Opening Three-Hour Persons by Mode for all Lanes on Southbound I-5

Measured Near 33rd Street

Mode	6 to 9 a.m. Number of Vehicles	Total Persons	Percent of Total Persons
Drive alone	7,056	7,056	65%
Carpool: 2-person	1,241	2,482	23%
Carpool: 3+ person	31	93	1%
Vanpools	6	66	1%
Trucks	481	481	4%
Motorcycles	6	6	0%
Buses	25	664	6%
TOTAL	8,847	10,848	100%

Occupancy counts (each mode's share of total traffic) and traffic counts taken in November 2001
Bus data obtained from C-Tran

Average vehicle occupancy = total number of persons/total number of vehicles
Average vehicle occupancy = 10,848/8,847 = 1.23

Average auto occupancy = total number of non-transit persons/total number of non-transit vehicles

Average auto occupancy = 10,184/8,821 = 1.15

Table 5a. Post Opening Three Hour Persons by Mode for Southbound I-5: HOV Lane

Measured near 33rd Street

Mode	6 to 9 a.m. Number of Vehicles	Total Persons	Percent of Total Persons
Drive alone	43	43	2%
Carpool: 2-person	741	1,482	63%
Carpool: 3+ person	25	75	3%
Vanpools	6	66	3%
Trucks	0	0	0%
Motorcycles	6	6	<1%
Buses	25	664	28%
TOTAL	846	2,336	100%

Calculations shown include spreadsheet rounding. Average of occupancy counts taken November 13 and 14, 2001.
Bus data obtained from C-Tran

Table 5b. Post Opening Three-Hour Persons by Mode for Southbound I-5: GP Lanes

Measured near 33rd Street

Mode	6 to 9 a.m. Number of Vehicles	Total Persons	Percent of Total Persons
Drive alone	7,013	7,013	82%
Carpool: 2-person	500	1,000	12%
Carpool: 3+ person	6	18	<1%
Vanpools	0	0	0%
Trucks	481	481	6%
Motorcycles	0	0	0%
Buses	0	0	0%
TOTAL	8,001	8,512	100%

Calculations shown include spreadsheet rounding. Average of occupancy counts taken November 13 and 14, 2001.
Bus data obtained from C-Tran

Average auto occupancy = total number of non-transit persons/total number of non-transit vehicles

Average auto occupancy = 10,184/8,822 = 1.15

Average vehicle occupancy = total number of persons/total number of vehicles

Average vehicle occupancy = 10,848/8,847 = 1.23

Table 6a. Baseline Peak Hour Persons by Mode for all Southbound I-5 Lanes

Measured Near 33rd Street

Mode	7 to 8 a.m. Number of Vehicles	Total Persons	Percent of Total Persons
Drive alone	2,669	2,669	74%
Carpool: 2-person	170	340	10%
Carpool: 3+ person	20	60	2%
Trucks	246	246	7%
Motorcycles	0	0	0%
Buses	11	264	7%
TOTAL	3,116	3,579	100%

Occupancy counts (each mode's share of total traffic) taken May 16 and 17, 2001
Traffic counts taken in September 2001
Bus data obtained from C-Tran

Average auto occupancy = total number of non-transit persons/total number of non-transit vehicles

Average auto occupancy = 3,315/3,105 = 1.07

Average vehicle occupancy = total number of persons/total number of vehicles

Average vehicle occupancy = 3,579/3,116 = 1.15

Table 6b. Post Opening Peak Hour Persons by Mode for all Southbound I-5 Lanes

Measured near 33rd Street

Mode	7 to 8 a.m. Number of Vehicles	Total Persons	Percent of Total Persons
Drive alone	2,220	2,220	62%
Carpool: 2-person	414	828	23%
Carpool: 3+ person	13	39	1%
Vanpools	4	44	1%
Trucks	184	184	5%
Motorcycles	0	0	0%
Buses	11	253	7%
TOTAL	2,846	3,568	100%

Occupancy counts (each mode's share of total traffic) and traffic counts taken in November 2001
Bus data obtained from C-Tran

Average auto occupancy = total number of non-transit persons/total number of non-transit vehicles

Average auto occupancy = 3,315/2,835 = 1.17

Average vehicle occupancy = total number of persons/total number of vehicles

Average vehicle occupancy = 3,568/2,846 = 1.25

Table 7a. Post Opening Peak Hour Persons by Mode for Southbound I-5: HOV Lane

Measured near 33rd Street

Mode	7 to 8 a.m. Number of Vehicles	Total Persons	Percent of Total Persons
Drive alone	17	17	2%
Carpool: 2-person	313	626	64%
Carpool: 3+ person	13	39	4%
Vanpools	4	44	4%
Trucks	0	0	0%
Motorcycles	0	0	0%
Buses	11	253	26%
TOTAL	358	979	100%

Calculations shown include spreadsheet rounding. Average of occupancy counts taken November 13 and 14, 2001.
Bus data obtained from C-Tran

Table 7b. Post Opening Peak Hour Persons by Mode for Southbound I-5: Two Through GP Lanes

Measured near 33rd Street

Mode	7 to 8 a.m. Number of Vehicles	Total Persons	Percent of Total Persons
Drive alone	2,203	2,203	85%
Carpool: 2-person	101	202	8%
Carpool: 3+ person	0	0	0%
Vanpools	0	0	0%
Trucks	184	184	7%
Motorcycles	0	0	0%
Buses	0	0	0%
TOTAL	2,488	2,589	100%

Calculations shown include spreadsheet rounding. Average of occupancy counts taken November 13 and 14, 2001.
Bus data obtained from C-Tran

Average auto occupancy = total number of non-transit persons/total number of non-transit vehicles

Average auto occupancy = 3,316/2,835 = 1.17

Average vehicle occupancy = total number of persons/total number of vehicles

Average vehicle occupancy = 3,569/2,846 = 1.25

Findings To Date

- Although the number of Three hour vehicles has decreased, the number of Three Hour person trips carried on the I-5 corridor has increased.
- There were 846 total HOV vehicles during the three hours of HOV operation, and approximately 400 during the peak hour.
- Bus ridership on I-5 routes has increased from 555 three-hour riders before the HOV lane opened to 664 Three Hour Period riders after the HOV lane opened.
- The HOV lane is carrying 22 percent of the person trips in 10 percent of the vehicles on I-5 during the three-hour period. During the peak hour, the HOV lane is carrying 27 percent of the person trips on I-5 in less than 13 percent of the vehicles.

2. Reduce peak period travel time for HOV lane users and reduce the average per-person travel time for all users.

Travel time will be measured by taking travel time runs in the field and making comparisons between the HOV and GP lanes.

Travel times are summarized for single-occupancy vehicles, high occupancy vehicles, and trucks (freight) in **Tables 8 and 9**. Since there is no HOV lane in the baseline condition, it is assumed that all of the vehicles on southbound I-5 have the same travel time. Travel time by segment has been averaged over multiple observations made in September 2001 during the 6 to 9 a.m. period using the moving vehicle method described in the appendix of this report. The travel times were categorized for vehicles traveling on the corridor between the 134th Street interchange and the Interstate Bridge. Travel times were measured between off ramps.

Table 8. Three-Hour Travel Time Results for HOV and General Purpose Users, 99th Street to Interstate Bridge (Average, 6-9 AM)

Travel Time in Minutes per Vehicle

I-5 Segment	Baseline Travel Time – All Users	Travel Time After HOV Opening		Travel Time Change from Baseline		HOV Travel Time compared to GP Lanes*
		General Purpose Lanes	HOV Lane	General Purpose Lanes	HOV Lane	
99th Street to SR-500	4.5	3.7	3.3	-0.8	-0.8	-0.4
SR-500 to Mill Plain	1.6	2.2	1.2	+0.6	-0.4	-1.0
Mill Plain to Interstate Bridge (south end)	3.5	2.5	2.3	-1.0	-1.2	-0.2
TOTAL	***9.6***	***8.4***	***6.8***	***-1.2***	***-2.8***	***-1.6***

Travel time runs over three different days in September 2001 and four different days in November-December 2001
*A negative number indicates the HOV lane is saving time compared to the GP lanes.

Findings To Date

- HOV saves users an average of 1-2 minutes per HOV vehicle over the entire Three Hour Period.
- GP users have experienced a slight increase (approximately one-half minute) between SR-500 and Mill Plain but an overall reduction in travel time over the entire Three Hour Period.
- Baseline travel times may be longer than normal due to construction on I-5 when baseline data were being collected.

Table 9. Peak Hour Travel Time Results for HOV and General Purpose Users

99th Street to Interstate Bridge, (Average, 7-8 AM)

I-5 Segment	Baseline Travel Time – All Users	Travel Time After HOV Opening		Travel Time Change from Baseline		HOV Travel Time compared to GP Lanes*
		General Purpose Lanes	HOV Lane	General Purpose Lanes	HOV Lane	
99th Street to SR-500	5.0	4.6	3.3	-0.4	-1.7	-1.3
SR-500 to Mill Plain	2.4	4.1	1.2	+1.7	-1.2	-2.9
Mill Plain to Interstate Bridge (south end)	4.9	5.6	3.9	+0.7	-1.0	-1.7
TOTAL	***12.3***	***14.3***	***8.4***	***+2.0***	***-3.9***	***-5.9***

Travel time runs over three different days in September 2001 and four different days in November-December 2001
*A negative number indicates the HOV lane is saving time compared to the GP lanes.

Findings To Date

- HOV saves users an average of 5-6 minutes per vehicle during the peak hour compared to GP users.
- GP users have experienced an increase of two minutes during the peak hour commute.
- Those GP users who merge onto I-5 from SR-500 experience an increase of 2.4 minutes during the average Three-hour Period.
- All of the GP increase in travel time is from SR-500 south to the Interstate Bridge.

3. Minimize impacts to other traffic in the corridor on parallel facilities.

With increased delay in the general-purpose lanes, there is a potential that traffic could divert to parallel routes, such as I-205, Highway 99 and Hazel Dell Avenue. Additionally, before and after counts were taken for Main Street south of I-5 and for Lakeshore Drive south of 99th Street to determine if traffic was diverting onto those facilities.

The share of traffic on each facility at the screenline at 99th Street is summarized in **Table 10**. **Tables 11 and 12** summarize before and after counts for Main Street and Lakeshore Drive.

Will be measured by taking before and after counts on Highway 99, Hazel Dell Avenue, and I-205.

Table 10. Facility Shares of North-South Traffic

Measure	I-5 Share (percent)	I-205 Share (percent)	Others Share* (percent)	Total Vehicles
Three Hour Period Baseline Share (September 2001)	29%	61%	10%	22,195
Three Hour Period Share, After HOV Opening (November 2001)	28%	61%	11%	23,910
Share Change, Baseline to This Report	-1%	0%	+1%	+1,715

I-5 and "Others" Measured at 99th Street. I-205 Measured at Mill Plain Boulevard.
*"Others" include Highway 99 and Hazel Dell Avenue.

Findings To Date

- The I-5 HOV Lane has not caused a significant shift to parallel routes.

Table 11. Traffic Counts south of 39th Street

Measure	I-5 Count	Main Street Count*
Three Hour Period Baseline 3 Hour Average Count* (September)	8,990	854
Three Hour Period Average Count, After HOV Opening (November)	8,847	1,208
Change, Baseline to This Report	-138	+354
% Change, Baseline to This Report	-2%	+42%

Measured at 39th Street (on I-5) and south of 39th Street (Main Street).
*Main Street southbound off ramp from I-5 was closed in the Baseline count period.

Note: I-5 counts at 179th Street and at Jantzen Beach both decreased by 2.5 to 2.8 percent between September and November 2001, reflecting a seasonal decrease in trip making on the I-5 corridor. Thus, it is expected that I-5 counts will in general be lower in November than in September due to seasonal fluctuation.

Findings To Date

- I-5 Three Hour Period traffic decreased 2% compared to baseline.
- Some I-5 traffic shifted onto Main Street after off-ramp was reopened in October.
- Main Street traffic is likely headed to downtown Vancouver, as the I-5 count south of the Interstate Bridge (at Jantzen Beach) also decreased approximately 3%, consistent with the I-5 decrease at 39th Street.

Table 12. Lakeshore Traffic Counts

Measure	Lakeshore Count
Three Hour Period Baseline Count (May)	1,043
Three Hour Period Count, After HOV Opening (November)	1,220
Change, Baseline to This Report	177
% Change, Baseline to This Report	17%

Measured south of 99th Street

Findings To Date

- Slight increase in traffic on Lakeshore.
- Since the I-5 count south of 99th Street did not change from baseline to this reporting period, it is likely that the increase on Lakeshore is attributable to other factors such as new development, seasonal fluctuations, or other normal traffic fluctuations.

4. Increase the use of carpools, vanpools, and transit.

Otherwise known as "ridesharing", this goal will be measured by vehicle counts and data from C-TRAN on ridership and Park and Ride utilization.

Persons in Carpools, Vanpools, and Transit

Table 13 shows the persons in carpools, vanpools, and transit before and after HOV opening. The after HOV opening persons are reported for I-5 users regardless of which lane they are using.

Table 13. Three-Hour Persons in Carpools, Vanpools and Transit on I-5

Location	Baseline Persons	After HOV Opening (November 2001)	
		All Through Lanes	HOV Lane Only
Carpools and Vanpools	1,079	2,647	1,563
Transit	555	664	664
TOTAL	1,634	3,311	2,227

Baseline is from September 2001
After HOV Opening is from November 2001

Findings To Date

- The HOV lane has contributed to an increase in the average auto and average vehicle occupancies on I-5.
- The HOV lane has increased the number of persons using I-5 in carpools, vanpools, and transit. Excluding eligible HOVs which are using the general purpose lanes, the HOV lane has led to an increase of almost 600 persons in carpools, vanpools, and transit compared to the baseline.
- Since vehicle volumes have decreased slightly while the number of persons in carpools and vanpools has increased significantly, a possible explanation is that HOV vehicles which were using I-205 in the baseline period have shifted over to the I-5 HOV lane.

Park-and-Ride Usage

Park-and-Ride usage can be used to measure the performance of the HOV lane. Changes in Park-and-Ride usage can be compared to changes in transit ridership to identify any patterns of increased or decreased transit usage.

Table 14. Park-and-Ride Usage

Location	Baseline Daily Usage (Vehicles)	Daily Usage after HOV Opening (November 2001)
Salmon Creek Park-and-Ride	439*	438*
Klineline Park	15	22

May 15-17, 2001 average (baseline)
November 2001 (post-opening)
*Salmon Creek Park-and-Ride is operating at capacity

Vanpools and Employer Programs

C-Tran offers a vanpool service program. C-Tran subsidizes 25 percent of the lease cost for vanpools traveling to or from Clark County. C-Tran also subsidizes the entire cost of fuel for vanpools traveling to or from Clark County and provides car wash coupons free of charge to vanpools participants. Eight (8) commuter vanpools carrying 86 vanpool riders currently operate. All 8 vanpools carry passengers from Washington to Oregon. Those vanpools go to Farmers Insurance, Tektronics, and Fred Meyers. Approximately 3 people contacted C-Tran in September inquiring about the vanpool program. C-Tran staff believes these calls were made from people who had participated in the Tri-Met vanpool program. Tri-Met recently implemented changes in its vanpool program and these people were seeking information on the benefits offered by the C-Tran program. Tri-met no longer offers vanpool programs for residents or businesses of Washington.

The number of vanpools currently operating is significantly less than past years. In February 2000, 15 vanpools were operating from Clark County to the Portland area. C-Tran staff believes the decline in vanpools is attributable to the slowing economy and associated job decreases.

5. Maintain safety by not increasing the accident and incident rate in the corridor during HOV lane operating periods.

Safety is measured by examining reported accidents before and after HOV lane opening. There is a time lag between the time of the accident and when the accident is recorded into the state's accident database. Therefore, reported accidents are not included in this report.

A secondary measure is also used to evaluate corridor safety, which consists of using WSP and WSDOT incident management vehicle callout logs. As needed, the WSP dispatches incident response requests to WSDOT through their traffic management center. WSDOT staff is available to respond to provide assistance to disabled vehicles, crash scenes, and other incidents. The number of callouts is a measure of safety. The Washington State Patrol (WSP) and WSDOT provided a detailed list of all reported collisions and call-outs on the southbound side of I-5 between 134th and the Interstate Bridge from 6 to 9 a.m. for the month of September (**Table 15)**. **Table 16** details the number of WSP and WSDOT call-outs on the southbound side of I-5 between 134th and the Interstate Bridge from 6 to 9 a.m. from the HOV lane's opening day for a total of three weeks. This correlates the number of callouts for incident management, accident scene traffic control, etc. with the safety information needed to evaluate the project.

Table 15. Baseline Three Hour Incident Management Callouts

WSP Call-Outs	WSDOT Incident Response Vehicle Callouts
On Roadway Incidents 4 property damage collisions 3 blocking disabled vehicles 2 traffic hazard reports	*On Roadway Incidents* 1 property damage collisions
Off-Roadway Incidents 2 abandoned non-blocking vehicles 1 disabled non-blocking vehicle	*Off-Roadway Incidents* 0 Off-Roadway incidents

September 2001 data (I-5 SB 6 to 9 a.m.)

Table 16. Post Opening Three Hour Incident Management Callouts

WSP Call-Outs	WSDOT Incident Response Vehicle Callouts
On Roadway Incidents 5 property damage collisions 7 blocking disabled vehicles 0 traffic hazard reports	*On Roadway Incidents* 0 property damage collisions
Off-Roadway Incidents 0 abandoned non-blocking vehicles 0 disabled non-blocking vehicle	*Off-Roadway Incidents* 0 Off-Roadway incidents

October 29 - November 16, 2001 data (I-5 SB 6 to 9 a.m.)

The evaluation period is too short to make any findings or conclusions regarding the safety and incident impacts of HOV lane operations.

Traffic Operations

WSDOT will also observe traffic operations along the I-5 corridor. Traffic operations will be reviewed to determine if adjustments need to be made to the HOV lane operations or endpoints.

Since the HOV lane opened, traffic operations have generally improved over the length of the HOV lane. During the first week of HOV operation, there were at least two days where general purpose lane traffic was slowed or queued due to incidents and weather-related delays. Since that time, traffic operations have improved overall.

6. Maintain the HOV lane's effectiveness at 15% violation rate or less.

A measure of the HOV's effectiveness is to examine its violation rate. This is measured in two ways: the number of observed violators using the auto occupancy counts taken for the HOV lane, and results of enforcement activities.

Tables 17 and 18 show the vehicle shares by auto occupancies and travel modes using the HOV lane during the HOV operating periods. The drive alone share in the HOV lane represents those who were observed violating the HOV restriction. Note that motorcycles are eligible HOV lane vehicles regardless of the number of occupants.

Table 17. Three-Hour HOV Lane Observed Violation Rates

Using Vehicle Occupancy Counts

Mode	Percent of Total Vehicles
Drive alone	5%
Eligible Vehicles	95%
TOTAL	100%
OBSERVED VIOLATION RATE	*5%*

Calculations shown include spreadsheet rounding. Average of occupancy counts taken November 13 and 14, 2001.

Table 18. Peak Hour HOV Lane Observed Violation Rates

Using Vehicle Occupancy Counts

Mode	Percent of Total Vehicles
Drive alone	5%
Eligible vehicles	95%
TOTAL	100%
OBSERVED VIOLATION RATE	*5%*

Calculations shown include spreadsheet rounding. Average of occupancy counts taken November 13 and 14, 2001.

The violation rate is 5 percent. The national violation rate average is in the 10-15% range. The ODOT HOV lane has a violation rate of 10%, which is within the national guidelines. The WSDOT HOV Lane has a violation rate of 5%, which is well within acceptable guidelines.

Enforcement

Another measure of the performance of the HOV lane is to track the number of HOV citations and warnings issued over time. For baseline conditions, the HOV lane was not operational; therefore, there were no HOV lane violations. The number and frequency of HOV lane violations after HOV lane opening are reported in **Table 19**.

Table 19. Enforcement Data

Category	Weekly Average	Daily Average
HOV Citations	7	1
HOV Warnings	25	5
Seat Belt Violations	4	1
No Insurance	8	2
Tows	2	1
# Car Officers	9	1.9
# M/C Officers	12	2.5
# Enforcement Hours	11	2.3

The enforcement data confirm the low violation rate in the HOV lane. Had the violation rate been higher, the number of warnings and citations would have been higher as well.

7. Maintain or improve HOV travel time reliability in the corridor.

HOV travel time reliability will be measured by determining if the HOV lane is maintaining an average speed of 45 mph or higher over the length of the lane. Additionally, on-time bus performance statistics will be evaluated.

Table 20. HOV Average Travel Speeds
Over Three Hour Period and Peak Hour

Time	Average Speed (MPH)
Three Hour Period 6-9 AM	
99th Street to SR-500	62
SR-500 to Mill Plain	57
Average over Length of HOV Lane	*61*
Peak Hour 7-8 AM	
99th Street to SR-500	61
SR-500 to Mill Plain	55
Average over Length of HOV Lane	*59*

Measured from 99th Street to Mill Plain Boulevard
Travel Time Runs from November-December 2001

- The HOV lane is maintaining at least 45 mph along its entire length both during peak hours and overall during the Three Hour Period.

Bus on-time performance statistics include measuring the travel time from the Salmon Creek Park-and-Ride to the Interstate Bridge. Compared to the arrival times in the baseline, the first post-opening results indicate that, on average, C-TRAN buses are arriving at the Interstate Bridge consistent with the HOV lane time savings reported earlier.

8. Maintain or improve public opinion as to the effectiveness of HOV lanes.

Surveys will be conducted once before and twice during the pilot project.

With the exception of the public opinion survey, all data will be collected every three months during the life of the evaluation period.

Three evaluation reports will be generated through the life of the evaluation period.

BASELINE PUBLIC OPINION SURVEY

Public opinion surveys will be taken to gauge public opinion about the HOV lane and HOV lanes in general before and during the Pilot Project. The first survey was commissioned in September 2001. Approximately 202 households were surveyed with a margin of error of ±6.89%. The following conclusions were drawn from the survey:

- Overall support of the WSDOT HOV lane was 58%, with 31% citing it is an excellent idea and 27% indicating it is a good idea. Fifteen percent (15%) believe the HOV lane is a fair idea and 27% believe it's a poor idea. Approval was exceptionally high with those residents who carpool two or more days a week (73%). Support among those residents who typically drive alone was approximately 50%.
- Overall, 48% of the respondents believe the WSDOT HOV lane should be permanently adopted. Thirty-six percent (36%) of the respondents believe the WSDOT HOV lane should not be permanently adopted, while 16% of the sample is undecided. Fifty-six percent (56%) of Vancouver residents support permanent adoption of the WSDOT HOV lane, as do 48% of members of the Salmon Creek/Hazel Dell zip code cluster. The strongest opposition comes from Battle Ground with 48% of residents opposing the lane, and North Clark County with 46% opposed, while 16% of the sample is undecided.
- Sixty-six percent (66%) of the respondents surveyed agree that the ODOT HOV lane is an excellent or good idea, with a large percent of support coming from Vancouver with 75%, and Salmon Creek/Hazel Dell, 67%. This is consistent with previous opinion surveys conducted for the ODOT HOV lane over the past three years.
- Reasons most often cited for <u>support</u> of WSDOT permanent HOV lane adoption were:

  Encourages carpooling/benefits carpoolers
  Less traffic tie ups/less cars
  Get there faster/save time
  Traffic moves better/faster

- Reasons most often cited for <u>opposition</u> of WSDOT permanent HOV lane adoption were:

  Would cause more delays/worsen the problem
  Not fair to single drivers
  Not used enough/waste capacity of lane
  Bridge/Delta Park area is problem

The following commuter statistics were drawn from the survey:

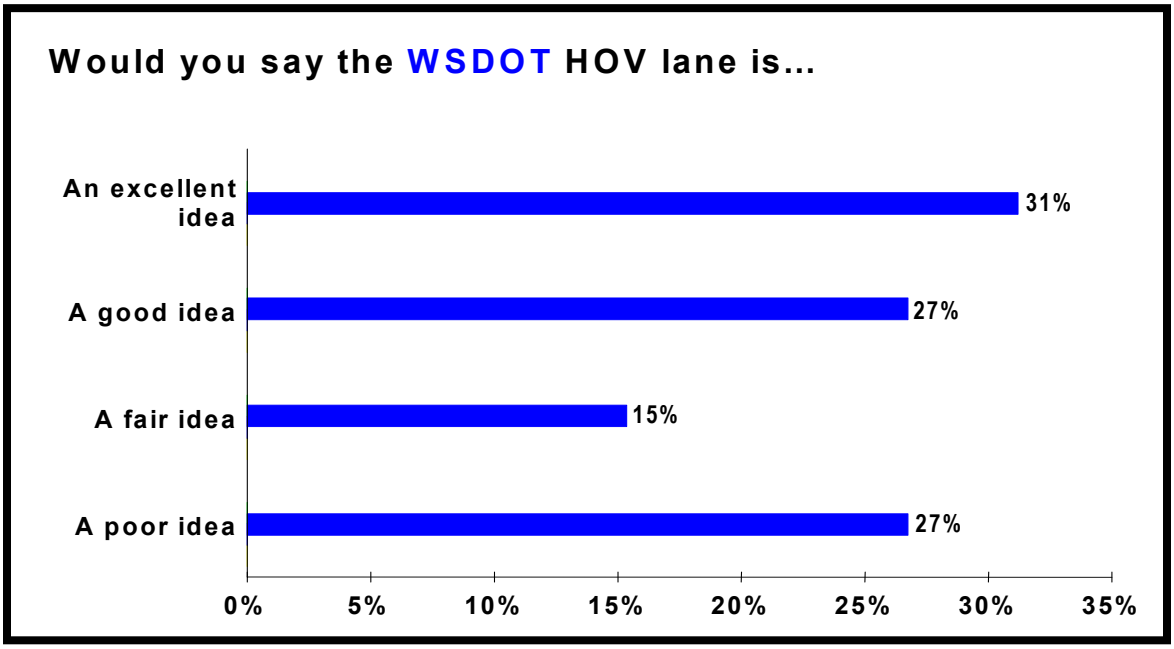
- Nearly 80% of the residents interviewed commute on I-5 between the 99th Street interchange and the Interstate Bridge for work, 10% for school or shopping, and 10% for

other reasons. A large portion of these residents, 57%, enters from South of the 99th Street interchange while almost 30% enter from the North.

- Ninety-six percent (96%) of those surveyed drive or carpool on I-5, traveling 25.4 minutes on average one way.
- Sixty-one percent (61%) of all commuters typically drive alone, while 25% usually drive or ride with someone else. The average number of passengers in a carpool is 2.6, with 58% of those who carpool two or more times per week traveling with family members.
- Vancouver residents usually drive or ride with someone else most often (37%) when compared to the other areas, like Salmon Creek/Hazel Dell where 20% of the respondents carpool.

Citizens in Battle Ground and North Clark County typically drive alone (80% and 73% of their populations respectively). Seventy-eight percent (78%) of commuters who drive alone at least three days a week do so because their daily routines prevent them from carpooling or taking the bus, despite the fact that a large portion of the survey sample, 94%, are aware of HOV lanes in the Portland/Vancouver area.

Baseline Public Opinion Survey Result



COMMENTS RECEIVED FROM EMAILS, LETTERS AND PHONE CALLS

Agencies within Clark County have received phone calls, letters, and emails regarding the HOV lane. Most were sent to WSDOT with some directed to RTC and others to C-TRAN. Comments generally were received from those stating they used I-5 as a regular commute, while other comments were received from elected officials and others with interest in the project. Some of the comments were received through the "Hot Issues" section of the web site of the local newspaper, The Columbian. Over 250 comments were received of as November 19, 2001.

WSDOT is recording these comments for consideration during the HOV evaluation process.

Several comments were received regarding the length of the commute after HOV opening; WSDOT directed the consultant team to collect additional travel time data to respond to these concerns. Additionally, comments received resulted in modifications to how data is being presented in this report; namely, the data is summarized for both the Three Hour HOV operating period and for the peak hour.

The next two public opinion surveys will be used to gauge public opinion using a scientifically valid random phone call survey of Clark County commuters on I-5.

KEY FINDINGS AND CONCLUSIONS TO DATE

- There were 846 total HOV vehicles during the Three Hour Period, and approximately 400 during the peak hour. The HOV lane is carrying 22 percent of the person trips in 10 percent of the vehicles on I-5 during the 3-Hour Period. During the peak hour, the HOV lane is carrying 27 percent of the person trips on I-5 in less than 13 percent of the vehicles. At this time, the HOV lane is not carrying more persons per lane than either of the adjacent general purpose lanes.
- The HOV lane has contributed to an increase in the average auto and average vehicle occupancies on I-5. The HOV lane has increased the number of persons using I-5 in carpools, vanpools, and transit. Excluding eligible HOVs which are using the general purpose lanes, the HOV lane has led to an increase of almost 600 persons in carpools, vanpools and transit compared to the baseline. Since vehicle volumes have decreased slightly while the number of persons in carpools and vanpools has increased significantly, it is likely that HOV vehicles which were using I-205 in the baseline period have shifted over to the I-5 HOV lane.
- The WSDOT HOV Lane has a violation rate of 5%, which is well within acceptable guidelines
- The HOV lane is maintaining at least 45 mph along its entire length both during peak hours and overall during the Three Hour Period
- Bus ridership on I-5 routes has increased from 555 Three Hour Period riders before the HOV lane opened to 664 Three Hour Period riders after the HOV lane opened.
- During the Three Hour Period, HOV saves users an average of 1-2 minutes per HOV vehicle over entire Three Hour Period. GP users have experienced a slight increase (approximately one-half minute) between SR-500 and Mill Plain but an overall reduction in travel time over entire Three Hour Period.
- During the peak hour, the HOV lane saves users an average of 5-6 minutes per vehicle compared to GP users. GP users have experienced an increase of two minutes during average peak hour commute. All of the GP increase in travel time is from SR-500 south to the Interstate Bridge. Although comments received give the perception that the increase in GP commute time is significant, even after additional travel time runs this could not be confirmed by the data.
- Prior to HOV opening, there was general overall support of the WSDOT HOV. A majority of those surveyed (58%) believe it is an excellent or good idea. Approval was exceptionally high with those residents who carpool two or more days a week (73%). Support among those residents who typically drive alone was approximately 50%.
- Overall, 48% of the respondents believe the WSDOT HOV lane should be permanently adopted. Thirty-six percent (36%) of the respondents believe the WSDOT HOV lane should not be permanently adopted, while 16% of the sample is undecided.
- Sixty-six percent (66%) of the respondents surveyed agree that the ODOT HOV lane is an excellent or good idea, with a large percent of support coming from Vancouver with 75%, and Salmon Creek/Hazel Dell, 67%.
- The evaluation period is too short to make any findings or conclusions regarding the safety impacts of HOV lane operations.

APPENDIX

Travel Time Methodology

The following is the methodology used for conducting travel time studies of the corridor. These were used to establish baseline conditions and will be used for the evaluation data collection.

1. Travel time runs begin at approximately 6 a.m. and end at approximately 9 a.m.
2. If there is an incident such as bad weather, construction, maintenance, or an accident that affects traffic, note it and continue the study. Note the weather, date, day of week, and time of the run. It is desirable that this be done at the beginning of each run.
3. Try to travel at the median speed. As necessary, pass slow moving vehicles and allow fast moving vehicles to pass, but try to make sure that an equal number of vehicles pass as are passed.
4. At each checkpoint, note the time. If the location gets cut off it can be deduced from the previous location by its order. If the time gets cut off and it cannot be figured out, the run will need to be done another day.